HHS Public Access

Author manuscript

J Epidemiol Community Health. Author manuscript; available in PMC 2019 May 17.

Published in final edited form as:

J Epidemiol Community Health. 2016 September ; 70(9): 917–923. doi:10.1136/jech-2015-207097.

The Association of Retirement Age with Mortality: A Population-Based Longitudinal Study among Older Adults in the United States

Chenkai Wu[1], **Michelle C. Odden**[1], **Gwenith G. Fisher**[2], and **Robert S. Stawski**[3]

[1]School of Biological and Population Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR, USA

[2]Department of Psychology, Colorado State University, Fort Collins, CO, USA

[3]School of Social and Human Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR, USA.

Abstract

Background—Retirement is an important transitional process in later life. Despite a large body of research examining the impacts of health on retirement, questions still remain regarding the association of retirement age with survival. We aimed to examine the association between retirement age and mortality among healthy and unhealthy retirees and to investigate whether socio-demographic factors modified this association.

Methods—Based on the Health and Retirement Study, 2,956 participants who were working at baseline (1992) and completely retired during the follow-up period from 1992 to 2010 were included. Healthy retirees (*n* = 1,934) were defined as individuals who self-reported health was not an important reason to retire. The association of retirement age with all-cause mortality was analyzed using the Cox model. Socio-demographic effect modifiers of the relation were examined.

Results—Over the study period, 234 healthy and 262 unhealthy retirees died, respectively. Among healthy retirees, a 1-year older age at retirement was associated with an 11% lower risk of all-cause mortality (95% CI 8 to 15), independent of a wide range of socio-demographic, lifestyle, and health confounders. Similarly, unhealthy retirees (*n* = 1,022) had a lower all-cause mortality risk when retiring later (Hazard ratio: 0.91, 95% CI 0.88 to 0.94). None of the socio-demographic factors were found to modify the association of retirement age with all-cause mortality.

Conclusion—Early retirement may be a risk factor for mortality and prolonged working life may provide survival benefits among U.S. adults.

Keywords

Mortality; retirement; retirement age

Corresponding Author: Chenkai Wu, MPH, MS, Oregon State University, 206 Bates Hall, Corvallis, OR, USA, 97331, (+1) 541-737-4878, wuche@onid.orst.edu.

Competing interests None.

INTRODUCTION

Retirement is one of most important transitional processes in later life. It has huge impacts on individuals' financial resources, daily activities, family relations, and social network [1]. Over the past several decades and until recently, workers have retired at younger ages in the United States (U.S.) as well as in many other developed countries [2, 3]. This trend towards early retirement along with several other ongoing demographic trends, including declining fertility rates, prolonged life expectancy, and delayed workforce entry by young adults, has contributed to a shrinking working population that may not be able to fiscally support a rapidly growing retired population [4, 5]. To alleviate fiscal pressure on the U.S. Social Security, the age eligibility for claiming full retirement benefits has been gradually increased from 65 to 67 years, and benefits available at age 62 have been reduced [6]. Most recently, research has pointed to a trend toward increased retirement age [7, 8]. Therefore, it is timely and critical to develop a better understanding of whether and how retirement age impacts retirees' health and longevity. Understanding the association of retirement age with longevity has important implications for post-retirement survival and may elucidate criteria for evaluating the current policies that aim to encourage older workers to retire later and to remain in the workforce.

There is a developing body of literature on the relation between retirement age and longevity, although the findings are mixed. Several studies reported higher mortality among early retirees than those who retired around the institutionally normative age [9–14], whereas others found no differences in longevity between early and on-time retirees [15–18] or even a lower mortality among individuals retiring early [19]. In sum, no consensus has been reached on the existence, direction, and magnitude of the association between retirement age and longevity.

One major methodological challenge in studying retirement age and mortality is how to account for the healthy worker bias [20]. Poor health is an important reason for early retirement [21, 22], and is also a well-established risk factor for mortality [23, 24]. Therefore, the adverse effects of early retirement on longevity may be, at least partially, attributable to workers' pre-retirement health status. Knowledge of the association of retirement age with longevity is also limited by the use of non-representative samples such as German firefighters [13], U.S. petrochemical workers [18], and Austrian blue-collar workers [11].

This study aimed to investigate the association of retirement age with mortality among U.S. adults to determine whether there is an optimal retirement timing to preserve longevity. This study also explored whether socio-demographic factors modified this relation. We addressed these issues using data from the Health and Retirement Study (HRS), a large, nationally representative prospective study of U.S. adults aged ≥51 years. To rigorously address the healthy worker bias, we restricted the primary analysis to participants who reported health had no impact on their decision to retire.

METHODS

Participants

We used data from the HRS collected between 1992–2010. The HRS is a cooperative agreement between the National Institute on Aging and the University of Michigan (U01 AG009740), and aims to describe changes in life patterns through the retirement transition among U.S. adults by collecting information about their health conditions, family network, social relations, financial situation, and employment status [25]. Ethical approval was obtained from the University of Michigan Institutional Review Board. Further details about the recruitment strategies, design, and sampling approaches of the HRS have been documented elsewhere [26]. There are currently 6 cohorts enrolled in the HRS. This study focused on the initial HRS cohort because it has the most waves of data for tracking the occurrence of retirement and death events, and other study cohorts are comprised of individuals who are either too young or too old, providing limited information on retirement.

The sample was first limited to 8,756 participants who were primary interview respondents (i.e. not from a proxy respondent), and had ≥2 valid assessments. The sample was further restricted to 4,092 participants who self-reported being working at baseline and had retired by the end of the 2010 wave of data collection. Moreover, because both occupation and pre-retirement health status were important confounders, 524 individuals whose occupation information was unavailable and 454 individuals who did not report whether health was an important reason to retire were excluded. Lastly, 158 individuals who were lost to follow-up in the year when they reported being completely retired were also excluded. These selection criteria resulted in a sample of 2,956 eligible participants. The flow of participants through each stage of selection based on inclusion criteria is shown in Figure 1.

To account for the healthy worker bias, the sample was stratified into two subgroups: healthy and unhealthy retirees, based on the question, “Was poor health very important, moderately important, somewhat important, or not important at all for retirement?” Individuals who answered “not important at all” were classified as healthy retirees, whereas individuals who chose one of the other three answers were considered unhealthy retirees. Consequently, the analytic sample consisted of 1,934 healthy retirees (from 1,782 households) and 1,022 unhealthy retirees (from 922 households).

Measures

Outcomes—The outcome was all-cause mortality. Participants were censored when lost to follow-up or the end of the analytic period (2010 survey wave). Mortality was ascertained based on a variable recording participants’ year and month of death taken from an exit interview or a spouse/partner’s core interview. Information on mortality was available through 2011.

Predictors—Retirement status was ascertained according to a question asking respondents in each wave: “At this time do you consider yourself partly retired, completely retired, or not retired at all?” An individual was defined as retired if they responded, “completely retired”.

Retirement age was defined as the age when an individual, for the first time, reported being completely retired.

Covariates—To account for potential confounders, socio-demographics (birth cohort, gender, race dichotomized as White/non-White, marital status dichotomized into married/non-married, education categorized as <high school, high school, and >high school, non-housing wealth, and pre-retirement occupation categorized into blue-collar, white-collar, and service), lifestyle information (smoking status, alcohol use, and physical activity), and health-related variables (body mass index, self-rated health, disability measured by difficulties performing activities in daily livings including walking across a room, bathing, eating, dressing, and getting into and out of bed, and medical history including hypertension, diabetes, cancer, lung disease, heart problem, stroke, arthritis, and psychiatric problems) were included in the multivariable analyses. All covariates were measured at baseline.

Statistical analysis

We first compared the mean values of baseline characteristics between healthy and unhealthy retirees, using a t-test for continuous variables and a chi-squared test for categorical variables. We then evaluated the distribution of retirement age for healthy and unhealthy retirees, separately.

We investigated the unadjusted association of retirement age with mortality among healthy retirees in a Cox model. Retirement age and its squared term were the primary predictors. The purpose of including this quadratic term was to test for a potential curvilinear relationship between retirement age and mortality. The quadratic term was included in subsequent models if it was associated with mortality at a significance level of $p < .05$. Subsequently, we included all of the aforementioned socio-demographics, lifestyles, and health-related variables as confounders in the model to estimate the adjusted hazard ratios (HRs) for the mortality risk per one-year increase in retirement age. Additionally, we examined the association of retirement age with mortality, modeling the continuously measured retirement age in categories to allow nonlinear association. We first classified healthy retirees as early, on-time, and late retirees using the first and the third quartiles of retirement age as cutoffs. Alternatively, we used Mean±1SD as cutoffs to classify healthy retirees into three categories.

We evaluated effect modification by including interaction terms between retirement age (continuous) and socio-demographics (birth cohort, gender, race, education, wealth, occupation, and marital status) in the model and testing for statistical significance. Interaction terms that did not reach statistical significance ($p \geq .05$) were excluded from the final model. We used Schoenfeld residuals to assess the proportional hazards assumption of Cox models.

As secondary analyses, Cox models were repeated for unhealthy retirees. Additionally, pooled models including both healthy and unhealthy retirees were fitted to test whether the association of retirement age with mortality differed across two subgroups. Furthermore, to assess the sensitivity of study results to classification of healthy retirees, we repeated the analyses using two more broad definitions of healthy retirees. Initially, we categorized participants who reported health was "somewhat important" to retiring as healthy retirees (*n* = 2,143). Alternatively, we categorized participants as healthy retirees (*n* = 2,342) if they reported health was "not at all", "somewhat", or "moderately important" for retirement. We used inverse-probability-of-attrition weights (IPAW) to account for potential selective attrition that may have arisen during follow-up.

We centered retirement age at 65 to reduce collinearity between linear and quadratic terms and to improve interpretation of the statistical results. We used robust standard errors to account for nested data structure of the HRS (i.e. participants nested within households). All statistical tests were two-sided. All analyses were conducted using Stata 13.1.

RESULTS

2,632 excluded participants were generally comparable to the included participants, except they were more often male and more likely to be white-collar workers (Supplemental Table 1).

Among 2,956 participants included, 1,934 (65.4%) and 1,022 (34.6%) were classified as healthy and unhealthy retirees, respectively. Over an average follow-up period of 16.9 years, 234 (12.1%) healthy and 262 (25.6%) unhealthy retirees died. Compared to unhealthy retirees, healthy retirees were more often men and white, more highly educated, and more likely married (Table 1). They were also more likely to be white-collar workers and had more wealth than unhealthy retirees. In addition, healthy retirees were more physically active, less likely to smoke, less likely to have a limitation in one or more activities of daily living, had a lower body mass index, fewer chronic conditions, and better self-reported health than unhealthy retirees. Overall, healthy retirees had relatively advantaged socio-economic, behavioral, and health profiles.

The distribution of retirement age was similar among healthy and unhealthy retirees, with a majority of people retiring around the age of 65 (Figure 2). The average retirement age (SD) was 64.9 (3.8) and 64.3 (4.1) and the range was 53.3–78.0 and 54.7–79.4 for healthy and unhealthy retirees, respectively.

Among healthy retirees, older retirement age was significantly associated with lower mortality in the unadjusted model (Table 2).

The addition of a quadratic term for retirement age did not add significantly to the model or alter the hazard ratio associated with the linear term for retirement age. The association of retirement age with mortality for healthy retirees remained nearly identical, after adjusting for socio-demographic, lifestyle, and health-related covariates; retiring one year later was associated with an 11% (95% CI 8 to 15) lower mortality risk. Based on the chi-squared tests, there was no strong evidence suggesting that the proportional hazards assumption was violated for any of the covariates in the adjusted model ($ps > 0.01$; $p = 0.38$ for global test). Results of interaction analysis showed that none of the socio-demographic factors significantly modified the association of retirement age and mortality.

When retirement age was modeled categorically, 466 and 483 healthy retirees were classified as early (< 62.4 years) and late (> 67.0 years) retirees using the first and the third quartiles as cutoffs, respectively. Alternatively, 252 and 297 healthy retirees were considered early (< 61.1 years) and late retirees (> 68.7 years) using Mean±1SD as cutoffs, respectively. The findings obtained using two categorization approaches consistently showed that early and late retirees had significantly higher and lower mortality risk compared to on-time retirees, respectively (Figure 3).

In the pooled analysis, unhealthy retirees had an 84% (95% CI 51 to 126) higher mortality risk than healthy retirees (Table 2). However, the association of retirement age and mortality did not differ between these subgroups (p=0.83). When unhealthy retirees were analyzed separately, retiring 1 year later was associated with a 9% (95% CI 6 to 12) lower mortality risk. The estimates for the association of retirement with mortality in healthy retirees remained almost unchanged when categorizing healthy retirees differently (Supplementary Table 2). Results were virtually unchanged when we applied IPAW to deal with potential selective attrition due to non-response (data not shown).

DISCUSSION

In a population-based longitudinal study of U.S. adults, we found early retirement was associated with increased mortality risk, and prolonged working life may be related to survival benefits among both healthy and unhealthy retirees, independent of a wide range of socio-demographic, lifestyle, and health-related confounds. By using a cohort of U.S. adults who do not face mandatory retirement and have a flexible retirement arrangement, we were able to extend previous research by showing late retirement was independently related to a reduced risk of mortality.

Our findings were consistent with previous investigations of Austrian, German, Greek, Swedish, and U.S. populations showing an increased mortality risk associated with early retirement [9–14]. Bamia et al.[9] found early exit from the workforce was a risk factor for mortality in Greek retirees who were free of chronic conditions prior to retirement. In a more recent investigation of Swedish residents who were healthy and employed at age 60, Carlsson et al.[10] showed early retirement was associated with an increased likelihood of death over the follow-up period.

The mechanisms behind the association of retirement age with mortality are generally not well understood. One possible explanation is employment is a key component of individuals' identity that provides them with substantial financial, psychosocial, and cognitive resources. Additionally, retirement could be a stressful life event associated with cognitive decline, difficulties in daily activities, morbidities, anxiety, and depression [20, 27–31]. Delayed transition into retirement and continued participation in volunteer activities and paid work in old age after retirement could delay the declines in physical, cognitive and mental functioning and reduce the risk of morbidities [32–36], which leads to better survival. This may be particularly true for individuals in working-oriented countries, where work is highly valued and considered a necessary part of life [37]. Work characteristics (e.g., more physically demanding or stressful jobs) may prompt earlier retirement that may have longer term effects on health and mortality even if workers do not retire due to health reasons [8]. Moreover, from the life course perspective, the decision about when to retire is shaped by many factors, including cultural and institutional norms; delayed transition into retirement may become more socially and culturally desirable [7, 38].

There was no evidence that the effects of retirement age on mortality were modified by socio-demographic characteristics, suggesting that the beneficial effect of retiring late may be universal across different socio-demographic profiles. Our findings are consistent with previous studies reporting an increased risk of mortality associated with retiring early in homogeneous populations [11, 13, 14]. Wagner et al.[13] found early retirement was a mortality risk among German firefighters. Kuhn et al.[11] reported a higher probability of dying before age 67 among male blue-collar workers who had access to early retirement than those who were ineligible.

Pooled analyses including both healthy and unhealthy retirees showed unhealthy retirees had relatively high mortality. These findings were in line with previous studies showing individuals who retired due to health-related reasons had relatively high mortality risk [13].

This study had several distinct substantive and methodological strengths. First, we used a large sample from a nationally representative study with rich socio-demographic, lifestyle, and health information. Second, we rigorously accounted for the confounding effects of pre-retirement health status by restricting the primary analysis to retirees who self-reported health was not important for retirement. Using self-reported information to define healthy retirees appeared valid, as evidenced by the fact that healthy retirees had relatively advantaged socio-economic, behavioral, and health profiles. Additionally, self-reported health is arguably better than objectively measured health since subjective evaluations of health may have the largest impact on an individual's choice to retire [39, 40]. Third, unlike most previous studies, we examined the health effect of both early and late retirement. Fourth, in addition to examining the main effect of retirement age on mortality, we investigated whether this relation differed across socio-demographic subgroups. Finally, this study had a long follow-up period, which allows the investigation of long-term survival and provides sufficient death events to achieve statistical power.

We acknowledge several limitations in this study. First, this study focused exclusively on retirement age and mortality. Future research should investigate the mechanisms by which retirement age impacts longevity to have a better understanding of the relationship between retirement age and trajectories of health and quality of life before and after retirement. Second, the question used in this study to define healthy retirees does not necessarily identify whether their health was the dominant reason for them to retire. The decision about when to retire is multifactorial and complex [8], it is possible that individuals who considered health was important for retirement indeed exit the workforce due to a variety of reasons related to, but not directly indicative of poor health, although we argue this definition was the most conservative approach to control for confounding by poor health status. Fourth, as with any observational study, residual confounding may persist if important confounders were omitted.

In general, this study adds to the retirement literature by studying a representative U.S. cohort and using a rigorous definition of healthy retirees. The study findings may have important implications for policies concerning the labor market, retirement, and later life health. In the context of rising longevity, changes in retirement ages across cohorts, and young adults delaying entry into the workforce, policymakers have pressed for policy changes encouraging late retirement to alleviate the old age dependency ratio. In addition to the economic and social impacts of delaying retirement age, it is also important to consider the health consequences of retirement for policy evaluation. This study suggests late retirement has a beneficial effect on longevity and early retirement is associated with higher mortality. In this sense, reducing early retirement benefits, providing social and economic incentives to prolong working life, and enacting policies that aim to postpone retirement may be beneficial for individuals' health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

The authors wish to thank Dr. Richard A. Settersten and Dr. Adam J. Branscum for their review of earlier versions of this manuscript.

Funding This work was supported by a grant from National Institute on Aging (NIA): R03-AG042919–01, and a Pilot Grant from the Michigan Center on the Demography of Aging: P30-AG012846

REFERENCES

1. Doyle Y, McKee M, Rechel B, et al. Meeting the challenge of population ageing. Bmj 2009;339:b3926. [PubMed: 19805472]
2. Gendell M Retirement age declines again in 1990s. Monthly Lab Rev 2001;124:12.
3. Wheaton F, & Crimmins EM. The demography of aging and retirement In: Wang M, ed. Handbook of Retirement: Oxford University Press 2013.
4. Leibfritz W Retiring later makes sense. Korea 2002;60:68.
5. Vaupel JW, Loichinger E. Redistributing work in aging Europe. Science 2006;312:1911–3. [PubMed: 16809529]
6. McGee JP, Wegman DH. Health and safety needs of older workers: National Academies Press 2004.
7. Fisher GG, Chaffee DS, Sonnega A. Retirement Timing: A Review and Recommendations for Future Research. Work, Aging and Retirement 2016:waw001.
8. Munnell AH. The Average Retirement Age: An Update. 2015.
9. Bamia C, Trichopoulou A, Trichopoulos D. Age at Retirement and Mortality in a General Population Sample The Greek EPIC Study. American Journal of Epidemiology 2008;167:561–9. [PubMed: 18056624]
10. Carlsson S, Andersson T, Michaëlsson K, et al. Late retirement is not associated with increased mortality, results based on all Swedish retirements 1991–2007. European journal of epidemiology 2012;27:483–6. [PubMed: 22669357]
11. Kuhn A, Wuellrich J-P, Zweimüller J. Fatal attraction? Access to early retirement and mortality. 2010.
12. Kühntopf S, Tivig T. Early retirement and mortality in Germany. European journal of epidemiology 2012;27:85–9. [PubMed: 22350223]

13. Wagner NL, Berger J, Flesch-Janys D, et al. Mortality and life expectancy of professional fire fighters in Hamburg, Germany: a cohort study 1950–2000. Environmental health : a global access science source 2006;5:27. [PubMed: 17020604]
14. Waldron H Links between early retirement and mortality: Social Security Administration, Office of Policy, Office of Research, Evaluation, and Statistics 2001.
15. Hernaes E, Markussen S, Piggott J, et al. Does retirement age impact mortality? Journal of health economics 2013;32:586–98. [PubMed: 23542020]
16. Hult C, Stattin M, Janlert U, et al. Timing of retirement and mortality-A cohort study of Swedish construction workers. Social science & medicine 2010;70:1480–6. [PubMed: 19932547]
17. Litwin H Does early retirement lead to longer life? Ageing and Society 2007;27:739–54.
18. Tsai SP, Wendt JK, Donnelly RP, et al. Age at retirement and long term survival of an industrial population: prospective cohort study. Bmj 2005;331:995. [PubMed: 16243848]
19. Brockmann H, Muller R, Helmert U. Time to retire--time to die? A prospective cohort study of the effects of early retirement on long-term survival. Social science & medicine 2009;69:160–4. [PubMed: 19467567]
20. Dave DRI, Spasojevic J. The Effects of Retirement on Physical and Mental Health Outcomes. Southern Economic Journal 2008;75:497–523.
21. Mein G, Martikainen P, Stansfeld SA, et al. Predictors of early retirement in British civil servants. Age and ageing 2000;29:529–36. [PubMed: 11191246]
22. Rice NE, Lang IA, Henley W, et al. Common health predictors of early retirement: findings from the English Longitudinal Study of Ageing. Age and ageing 2011;40:54–61. [PubMed: 21148324]
23. Harris SE, Deary IJ, MacIntyre A, et al. The association between telomere length, physical health, cognitive ageing, and mortality in non-demented older people. Neuroscience letters 2006;406:260–4. [PubMed: 16919874]
24. Lee Y The predictive value of self assessed general, physical, and mental health on functional decline and mortality in older adults. Journal of epidemiology and community health 2000;54:123–9. [PubMed: 10715745]
25. Juster FT, Suzman R. An overview of the Health and Retirement Study. Journal of Human Resources 1995:S7–S56.
26. Heeringa SG, Connor JH. Technical description of the health and retirement survey sample design. Ann Arbor: University of Michigan 1995.
27. Bossé R, Aldwin CM, Levenson MR, et al. Mental health differences among retirees and workers: findings from the Normative Aging Study. Psychology and aging 1987;2:383. [PubMed: 3268232]
28. Elwell F, Maltbie-Crannell AD. The impact of role loss upon coping resources and life satisfaction of the elderly. Journal of Gerontology 1981;36:223–32. [PubMed: 7204904]
29. Kim JE, Moen P. Retirement transitions, gender, and psychological well-being a life-course, ecological model. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences 2002;57:P212–P22.
30. Olesen K, Rugulies R, Rod NH, et al. Does retirement reduce the risk of myocardial infarction? A prospective registry linkage study of 617 511 Danish workers. International journal of epidemiology 2014;43:160–7. [PubMed: 24408969]
31. Roberts BA, Fuhrer R, Marmot M, et al. Does retirement influence cognitive performance? The Whitehall II Study. Journal of epidemiology and community health 2010:jech. 2010.111849.
32. Dufouil C, Pereira E, Chêne G, et al. Older age at retirement is associated with decreased risk of dementia. European journal of epidemiology 2014;29:353–61. [PubMed: 24791704]
33. Fisher GG, Stachowski A, Infurna FJ, et al. Mental work demands, retirement, and longitudinal trajectories of cognitive functioning. Journal of Occupational Health Psychology 2014;19:231. [PubMed: 24635733]
34. Luoh M-C, Herzog AR. Individual consequences of volunteer and paid work in old age: Health and mortality. Journal of Health and Social Behavior 2002:490–509. [PubMed: 12664678]
35. Rennemark M, Berglund J. Decreased cognitive functions at the age of 66, as measured by the MMSE, associated with having left working life before the age of 60: Results from the SNAC study. Scandinavian journal of public health 2014;42:304–9. [PubMed: 24482431]

36. Stenholm S, Westerlund H, Salo P, et al. Age-related trajectories of physical functioning in work and retirement: the role of sociodemographic factors, lifestyle and disease. Journal of epidemiology and community health 2014;68:503–9. [PubMed: 24534071]

37. Oakman J, Wells Y. Retirement intentions: what is the role of push factors in predicting retirement intentions? Ageing and Society 2013;33:988–1008.

38. Fisher GG, Ryan LH, Sonnega A. Prolonged Working Years: Consequences and Directions for Interventions Sustainable Working Lives: Springer 2015:269–88.

39. Bound J Self-reported vs. objective measures of health in retirement models. National Bureau of Economic Research 1989.

40. Adams GA, Beehr TA. Retirement: Reasons, processes, and results: Springer Publishing Company 2003.

Author Manuscript

Author Manuscript

Author Manuscript

What is already known on this subject

- Previous studies reported conflicting results regarding the health effects of retirement age.
- Prior research has not sufficiently accounted for the healthy worker bias.
- The health effects of late retirement have been rarely examined.

What this study adds

- Early retirement may be a risk factor for mortality and prolonged working life may provide survival benefits.
- The relation between retirement age and mortality did not vary across socio-demographic subgroups.

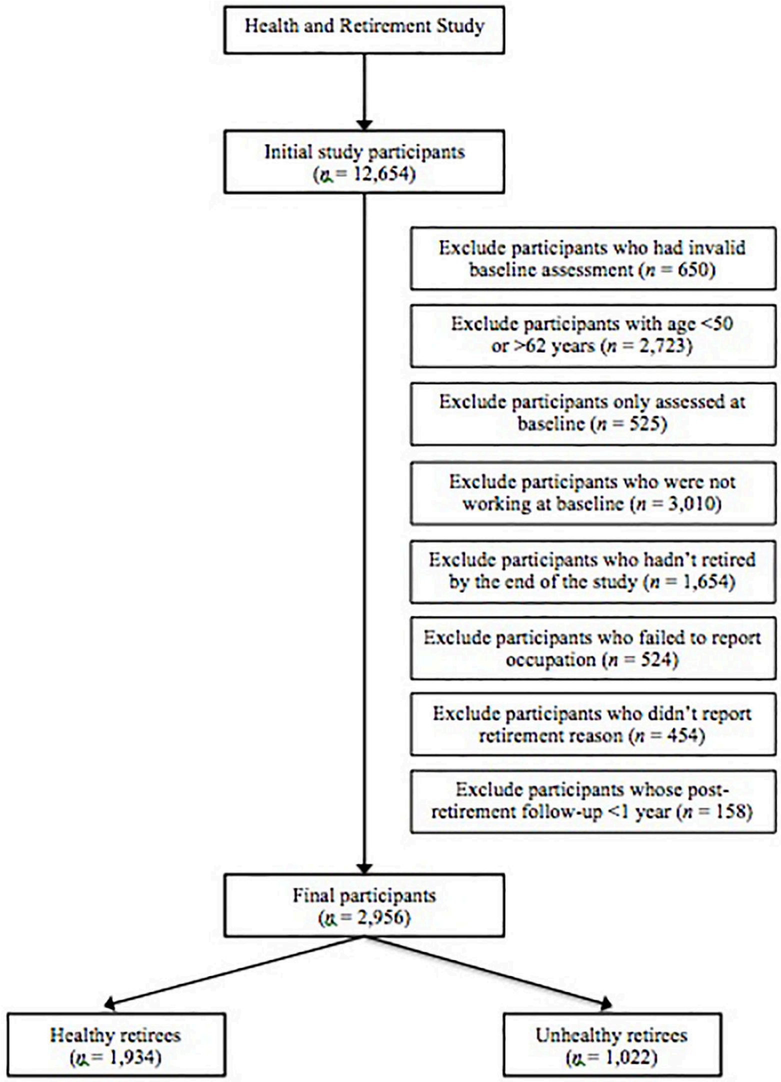

Figure 1.

Flow Chart of Participants Excluded from the Present Study, Health and Retirement Study, 1992–2010

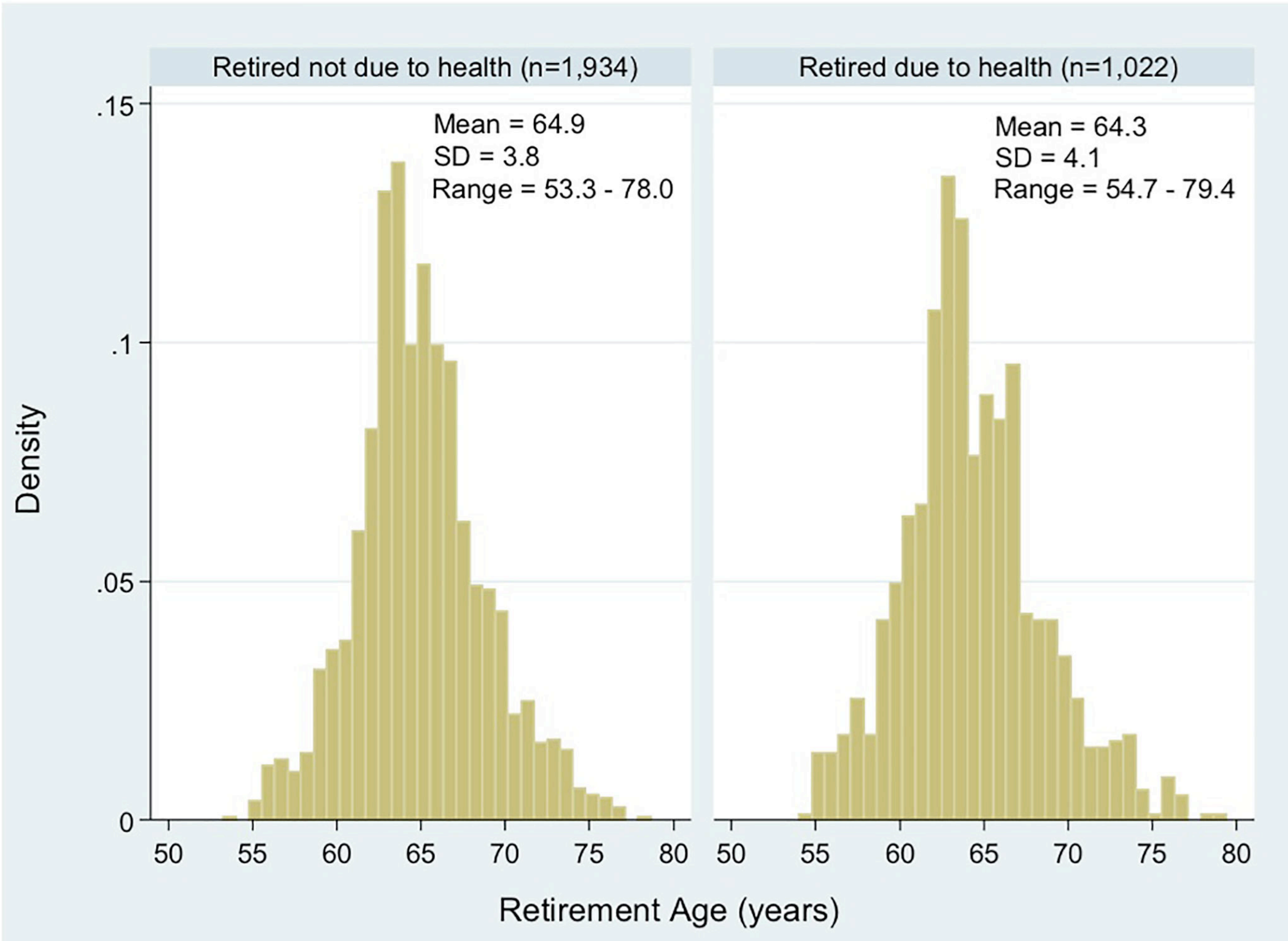

Figure 2.

Distribution of Retirement Age for Healthy and Unhealthy Retirees, Health and Retirement Study, 1992–2010

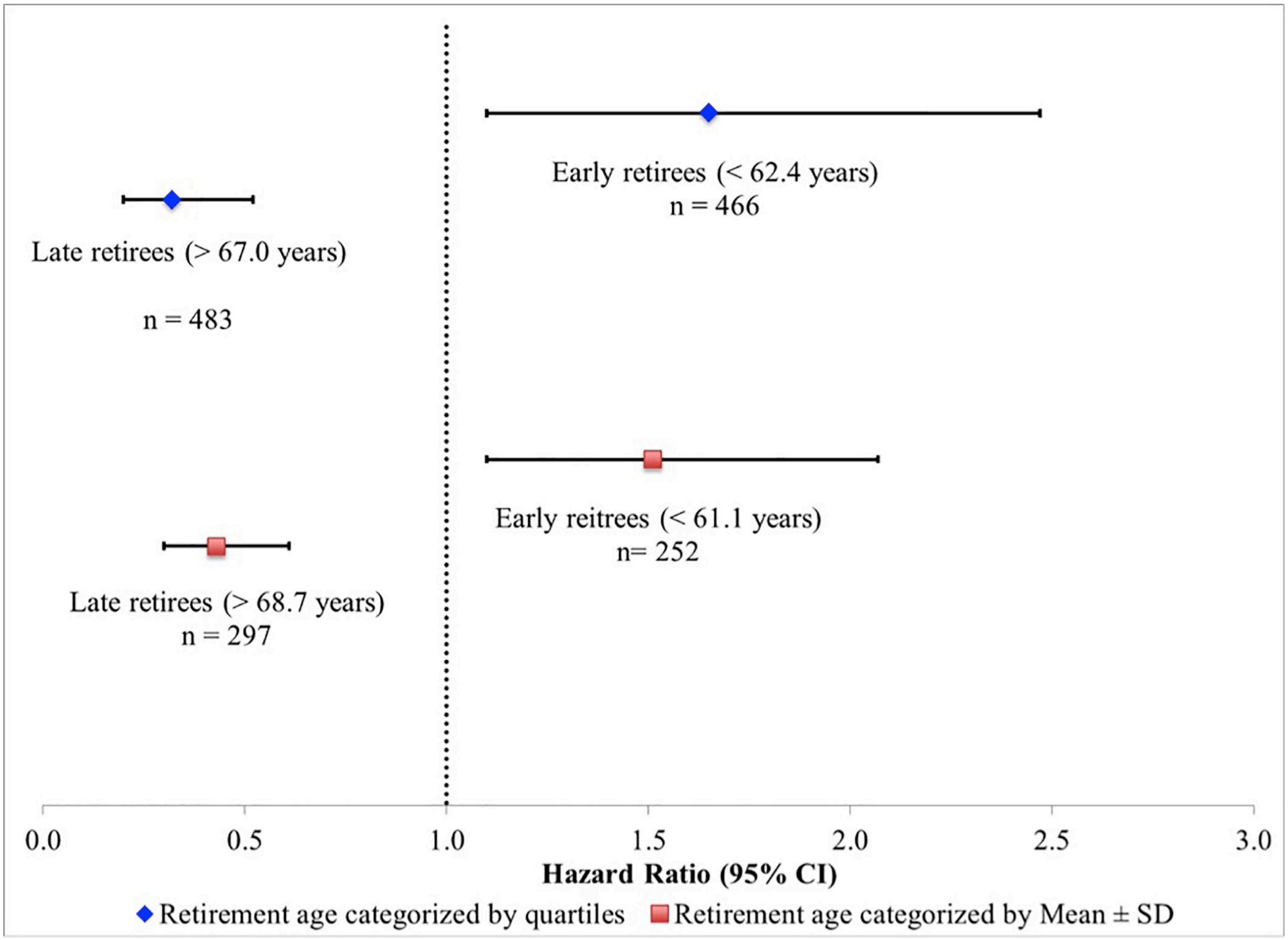

Figure 3.

Association of Categorized Retirement Age with Mortality in Healthy Retirees, Health and Retirement Study, 1992–2010

Note. On-time retirees were considered reference group

Table 1.

Demographic, Behavioral, and Health Characteristics of Participants (Healthy Retirees vs. Unhealthy Retirees), Health and Retirement Study, 1992–2010

	Healthy retirees (*n* = 1,934)	Unhealthy retirees (*n* = 1,022)	
	Mean ± SD or Count (%)		*P* value[a]
Male	967 (50.0%)	457 (44.7%)	**
White (vs. non-white)	1628 (84.2%)	775 (75.8%)	***
Age	55.5 ± 3.0	55.1 ± 3.1	***
Education			***
< High school	307 (15.9%)	285 (27.9%)	
High school	1092 (56.4%)	562 (55.0%)	
> High school	535 (27.7%)	175 (17.1%)	
Married (vs. others)	1487 (76.9%)	666 (65.2%)	***
Non-housing wealth			***
Min – 1st quartile	405 (20.9%)	351 (34.3%)	
1st quartile – median	472 (24.4%)	262 (25.6%)	
Median – 3rd quartile	498 (25.8%)	251 (24.6%)	
3rd quartile – max	559 (28.9%)	158 (15.5%)	
Occupation			***
White-collar	680 (35.2%)	231 (22.6%)	
Service	756 (39.1%)	446 (43.6%)	
Blue-collar	498 (25.8%)	345 (33.8%)	
Smoking			***
Never-smoker	754 (39.0%)	337 (33.0%)	
Former	756 (39.1%)	373 (36.5%)	
Current	424 (21.9%)	312 (30.5%)	
Alcohol use (yes)	1307 (67.6%)	622 (60.9%)	***
Frequent exercise	1041 (53.8%)	498 (48.7%)	**
Body mass index			***
Underweight/normal	728 (37.6%)	282 (27.6%)	
Overweight	843 (43.6%)	422 (41.3%)	
Obese	363 (18.8%)	318 (31.1%)	
Self-rated health	3.9 ± 0.9	3.3 ± 1.1	***
Limitation in ≥1 ADL	42 (2.2%)	81 (7.9%)	***
Chronic conditions	0.9 ± 0.9	1.5 ± 1.2	***
Death	234 (12.1%)	262 (25.6%)	***

Abbreviations: SD, standard deviation; ADL, activities in daily living

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$

[a]Two-sample t-test for continuous variables and χ^2 test for categorical variables.

Author Manuscript
Author Manuscript
Author Manuscript

Table 2.

Association of Retirement Age with Mortality, Stratified by Healthy vs. Unhealthy Retirees, Health and Retirement Study, 1992–2010

	Healthy Retirees (*n* = 1,934)		Unhealthy Retirees (*n* = 1,022)		Pooled Analysis[a] (*n* = 2,956)	
	HR	95% CI	HR	95% CI	HR	95% CI
Unadjusted						
Retirement Age (centered at 65)	0.89	0.86–0.92	0.90	0.87–0.92	0.89	0.87–0.91
Adjusted[b]						
Retirement Age (centered at 65)	0.89	0.85–0.92	0.91	0.88–0.94	0.90	0.88–0.92
Retired due to health (Yes)	-	-	-	-	1.84	1.51–2.26
Male	1.66	1.21–2.27	1.79	1.33–2.43	1.75	1.41–2.17
White (vs. non-white)	1.11	0.75–1.66	1.03	0.76–1.40	1.04	0.82–1.33
Birth cohort (centered at 1931)	1.02	0.96–1.09	1.01	0.96–1.07	1.02	0.98–1.06
Education (ref. < high school)						
High school	0.67	0.47–0.96	0.85	0.63–1.15	0.79	0.62–0.99
> High school	0.66	0.40–1.07	1.21	0.73–2.00	0.90	0.63–1.28
Married (vs. others)	0.81	0.59–1.13	0.98	0.73–1.33	0.90	0.72–1.13
Wealth (ref. <1st quartile)						
1st quartile – median	1.21	0.83–1.76	0.96	0.69–1.35	1.09	0.85–1.39
Median – 3rd quartile	0.97	0.64–1.47	0.90	0.63–1.30	0.93	0.71–1.22
3rd quartile – max	0.97	0.63–1.49	0.90	0.57–1.42	0.91	0.67–1.23
Occupation (ref. White-collar)						
Service	0.93	0.64–1.35	1.30	0.84–2.01	1.11	0.84–1.48
Blue-collar	0.97	0.64–1.46	1.19	0.77–1.83	1.09	0.81–1.46
Smoking (ref. never-smokers)						
Former smokers	1.25	0.88–1.77	1.37	0.96–1.93	1.33	1.04–1.71
Current smokers	2.66	1.88–3.77	2.55	1.82–3.57	2.59	2.03–3.31
Drinking (yes)	0.94	0.70–1.27	0.85	0.65–1.12	0.90	0.73–1.10
Frequent exercise (yes)	1.04	0.80–1.34	0.74	0.57–0.95	0.87	0.72–1.04

	Healthy Retirees (n = 1,934)		Unhealthy Retirees (n = 1,022)		Pooled Analysis[a] (n = 2,956)	
			HR	95% CI		
BMI (ref. normal/low)						
Overweight	0.89	0.66–1.19	1.07	0.78–1.47	0.97	0.78–1.20
Obese	1.24	0.86–1.77	1.09	0.76–1.55	1.13	0.88–1.46
Self-rated health	0.90	0.77–1.05	0.91	0.80–1.05	0.91	0.82–1.01
Chronic conditions	1.22	1.05–1.40	1.12	1.00–1.26	1.16	1.06–1.27
Limitation in any ADL	2.32	1.18–4.56	0.97	0.64–1.48	1.14	0.79–1.66

Abbreviations: HR, hazard ratio; CI, confidence interval; BMI, body mass index.

[a]Both healthy and unhealthy retirees were included. P-value for interaction Retirement age × Retired due to health (yes or no) = 0.834

[b]Estimates adjusted for socio-demographic (birth cohort, gender, marital status, education, wealth), lifestyle (smoking status, alcohol use, body mass index), and health-related (self-rated health, medical history, and activities in daily living) measures.